Science and Engineering Workforce
How can we meet DoD's needs?

Defense Acquisition Performance Assessment Panel

Presented by

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DAPA 9-15-05.ppt

Overview

Scientists and Engineers Create Battlefield Advantage -- the Supply of Clearable S&Es is in question

- Situation
- Goal
- Approach
- Summary & Requirements

Situation

As Technological Advantage decreases
Battlefield Advantage decreases and
the Threat of Technological Surprise increases

S&E Workforce Concerns

- Interest diminishing - Supply diminishing - Demand increasing
  (Trends and dominant opinions - no definitive data or predictive models)
- Public & Private concern & desire to engage abound
- No National strategy – No lead entity – No silver bullet
- DoD must satisfy its needs – has authority & capacity to do so

Existing Efforts could achieve more

- Decentralized leadership & engagement
- Hundreds to Thousands of
  individual, independent, disconnected efforts nationally
- Alignment required for substantial & sustainable impact

Supply – Demand – Impact

STEM* Academia

- Reduced US Citizen performance, interest, enrollment, degrees
- Some Departments already sub-critical
- Full spectrum, comprehensive intervention required (K-20+)

Defense Industry (NDIA survey, Nov. 2005)

- "Perfect Storm" analogy is real & having impact
- Unsatisfied needs exist - expected to continue and increase
  (Snapshot Survey: ~15% open SE requisitions – contract let, need body to work)

DoD has Highest Exposure

- National Defense Workforce cannot be allowed to go sub-critical
- ~200,000 total Federal S&E's, ~45% work for DoD
  (~70%-90% in some Key disciplines)
- ~40+% in some S&E fields (in DoD) can retire – Right Now!

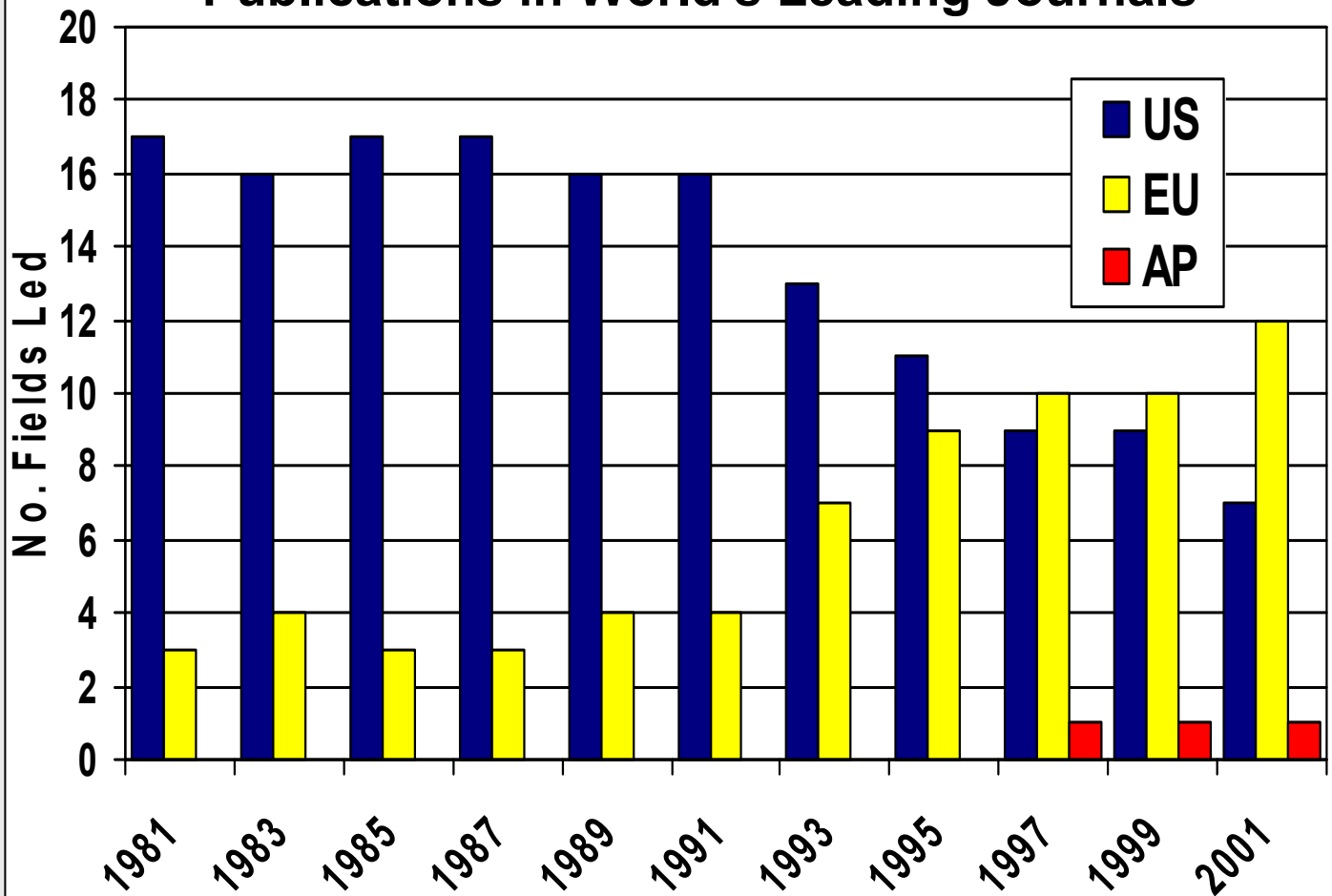
*STEM (Science, Technology, Engineering and Mathematics)

World Technology Leadership

20 Technology Areas-
(Led by US in 2001)

Agricultural Science
Biology & BioChem
Chemistry
Clinical Medicine
Computer Science
Ecology & Enviroment
Engineering
Geoscience
Immunology
Materials Science
Math
Microbiology
Molecular Bio & Genetics
Multidisciplinary
Neuroscience
Pharmacology
Physics
Plant & Animal Science
Psych & Psychiatry
Space Science

Scientific Fields Led - Measured by Publications in World's Leading Journals



From: Shelton, Holdridge briefing; Data Source: Thomson Scientific, National Science Indicators, ISI 2002, Copyright retained

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Goal

Ensure that DoD Science and Engineering Workforce needs are met

Comprehensive strategy:

- Institutionalize commitment and response within DoD
- Align all DoD STEM activities to increase ROI (K-20+)
- Identify and expand proven practices across DoD
- Engage enthusiastic stakeholders

- Collateral benefit – a catalyst & model for National action

Three - Component Strategy

- Create human resource systems that are competitive and reward performance
- Engage and guide students and teachers through research, education, competitions, and practical experiences
- Invest in world-class facilities and equipment to exploit major evolving trends in science and engineering

S&E Workforce
Some Current Efforts Across DoD

Pre-college (K-12)

- **Materials World Modules (Ray Pawlicki – Army)**
- **STARBASE – (Ernie Gonzales – OSD-RA)**
- **eCybermission – (Kelly Stratchko – Army)**

Undergraduate

- **Awards to Stimulate & Support Undergraduate Research Education (ASSURE) (with NSF; Koto White – AFOSR)**
- **Research Assistantships in microelectronics (with Semiconductor Industries Association) (Dan Radack – DARPA)**
- **Science, Mathematics and Research for Transformation (SMART) (K. Thompson – DoD/Koto White - AFOSR)**
- **Science, Mathematics and Research for Transformation (SMART)/National Defense Education Act (NDEA), Phase I (K. Thompson – DoD/Peter Purdue - NPS)**

S&E Workforce
Some Current Efforts Across DoD

Graduate

- National Defense Science & Engineering Graduate Fellowships (NDSEG)
- Naval Research – Science and Technology for Americas Readiness (N-STAR – with NSF, Bob Kavetsky – Navy)
- SMART (Keith Thompson/Koto White – AFOSR)
- SMART/NDEA (Keith Thompson/Peter Purdue-NPS)

SMART 05

Science Mathematics and Research for Transformation (SMART)

Congressional Add in FY05 Authorization & Appropriation

- Undergraduate/Graduate Scholarship Pilot Program
- US Citizens only (legislative limitation)
- Disciplines deemed critical to national defense
- 2 yrs of support (max – effective limitation due to pilot status)
- Service Payback required
- $ 2.5M

Implementation

- Internship required (outside of program)
- Mentorship required (outside of program)
- Post-degree work payback (set to 1-1 non-employee/3-1 employee)
- Participants: Army, Navy, Air Force, DARPA, DISA, DTRA

- 32 awards provided – students begin in Fall Semester, 2005

SMART/NDEA 06

Science Mathematics and Research for Transformation (SMART)/ National Defense Education Act (NDEA) 2006, Phase I

SMART/NDEA 06 amendment enables comprehensive approach to education and training – <u>Shaped Workforce</u>

- **SMART 05 is a valuable foundation (PE, execution & pgm components)**
- **Permanent program vs pilot**
- **Provides both Academic and Non-Academic elements (within program)**
- **Employee status while enrolled sought**
- **Expansion of skill/discipline/degree sought (language/associates)**
- **Will drive greater awareness of S&T workforce needs & planning**
- **Designed for DoD-wide S&T workforce utility (widening interest/support)**
- **Planned level expected to meet 10% of anticipated needs over 10 years**
- **Increased funding sought**

Approach

Agency response is proportional to Leaders' attention

- Set STEM Workforce needs among Highest DoD Priorities
  - Eroding foundation weakens the structure
- Assign central responsibility, require results
  - Status/Action/Needs briefing to (Dep)SecDef every X months
  - Not withdrawing delegated authorities – organizing them
- Bring all Components on board
  - All Components are authorized
- Align efforts
  - DoD is rich in Talent and Technology
  - Improve effectiveness of efforts
  - Partnerships are critical

Summary / Requirements

Ensuring the U.S. Science and Engineering workforce is an issue of National Security

Data, Trends and Reports substantiate concern & action

DoD Specific - Leadership Attention & Action

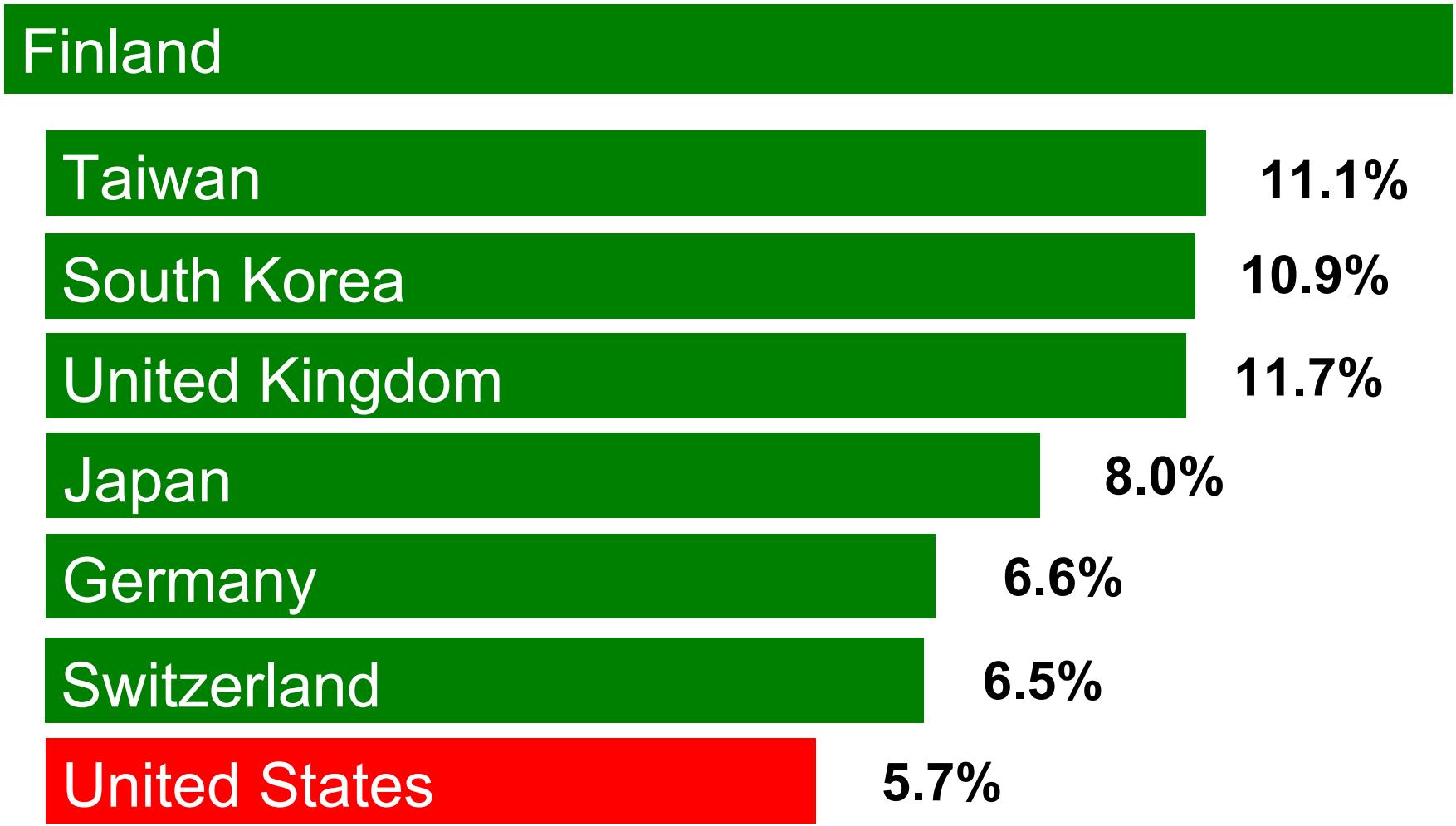
- (Dep)SecDef Publicity & Memorandum to:
  - Set clear priority and direction for DoD S&E Workforce & STEM Ed efforts
  - Assign responsibility & require engagement
  - Establish level of effort – scope and scale
  - Identify Specific actions & follow up (Continue attention thru institutionalization)
    (Engage Components, Build Action Plan, Brief, Scale, Implement, Measure, Brief)

National Level

- DoD (with others) raise issue at Principals & Deputies level
- Cabinet level recognition & priority is mandatory
- No national strategy = No sustainability & Marginal Impact

BACKUP

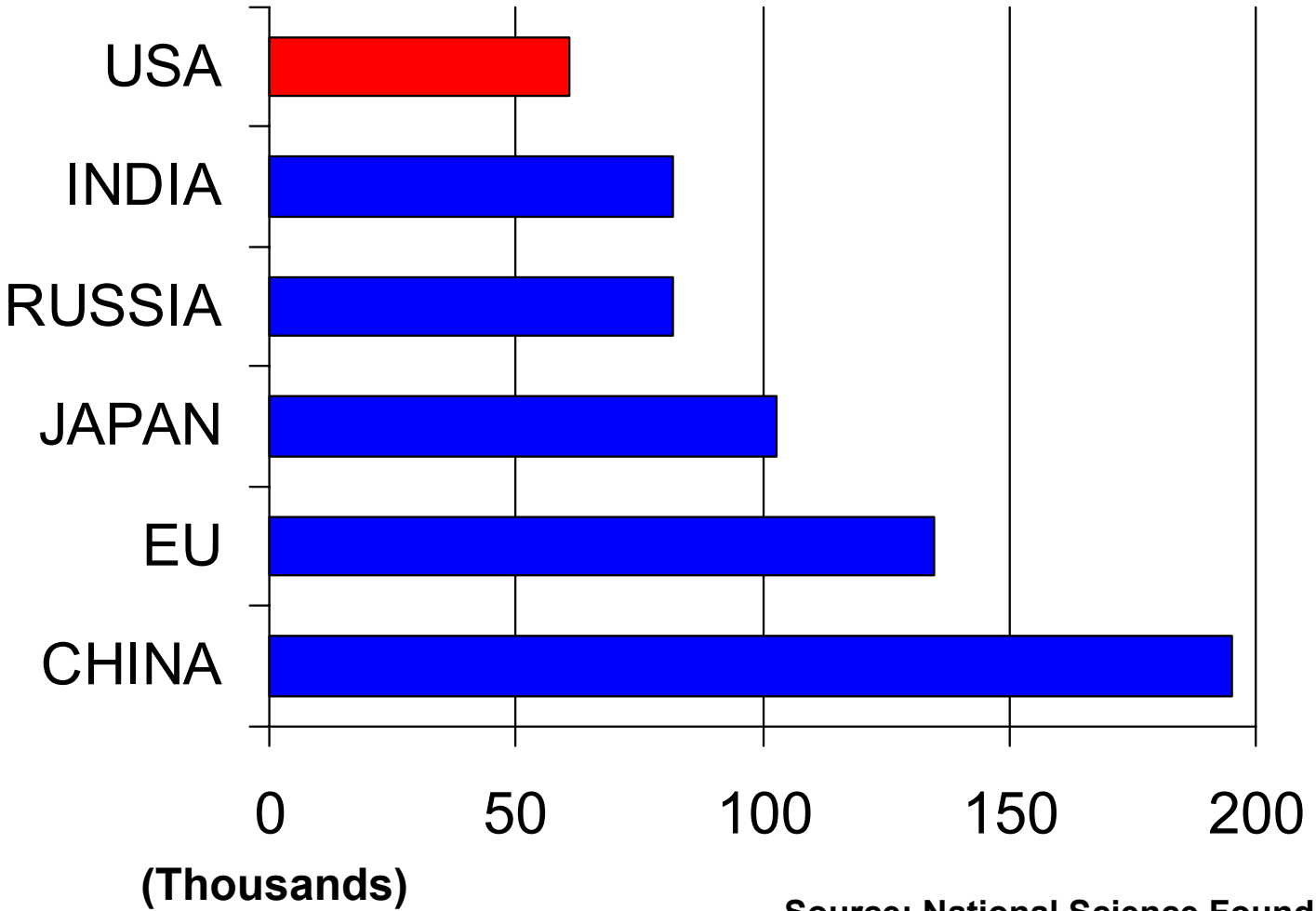
Percentage of 24-year-olds with a Science or Engineering Degree



Source: Money Magazine, Oct 2004, pg 124

Degrees Awarded in Engineering

Bachelor in Engineering Degrees Awarded - 1999



Source: National Science Foundation

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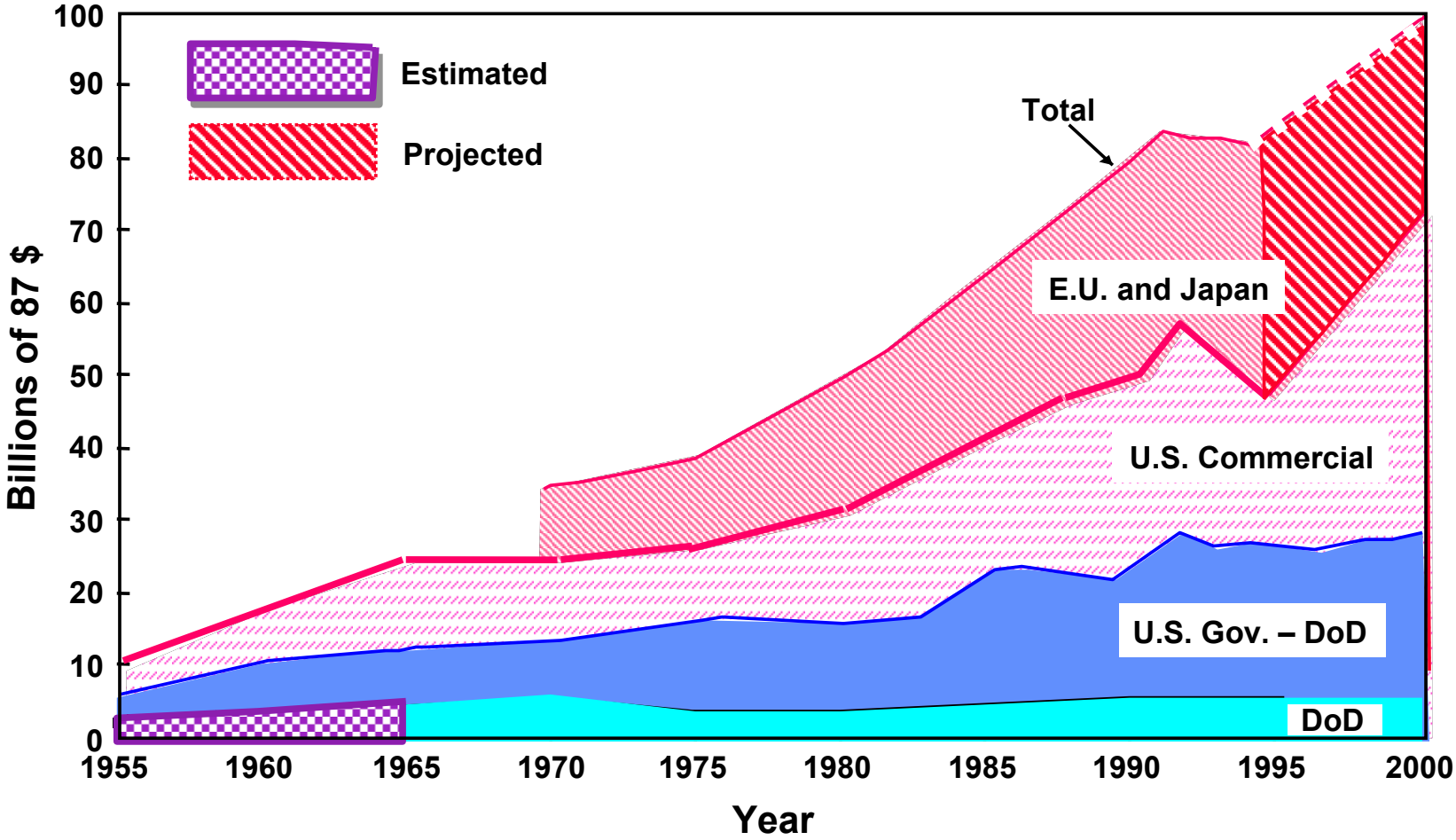
U.S. and Worldwide Research Base Since WWII



Source: Report of the Defense Science Board Task Force on the Technology Capabilities of Non-DoD Providers; June 2000; Data provided by the Organization for Economic Cooperation and Development & National Science Foundation

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DoD S&Es as % of Total Fed S&Es

Source: NSF 05-304, Table 16 –Federal Scientists and Engineers 1998-2002, by agency and major occupational group: for 1998-2002 (OPM data)

	1997	1998	1999	2000	2001	2002
Total S&Es	46.6%	45.8%	44.2%	43.5%	43.1%	43.4%
All sci	28.0%	27.4%	26.1%	25.4%	25.6%	26.9%
Comp/Math sci	48.8%	47.6%	45.5%	43.9%	44.0%	45.3%
Life sci	12.2%	12.0%	11.4%	11.2%	11.0%	10.9%
Physical sci	28.2%	27.5%	26.7%	26.2%	26.1%	26.2%
Social sci	21.9%	21.4%	20.4%	20.4%	19.7%	19.6%
All eng	67.3%	67.0%	66.7%	66.4%	66.2%	66.7%
Aerospace	46.7%	45.2%	44.7%	43.6%	43.0%	42.8%
Chemical	61.3%	60.8%	62.3%	63.6%	65.7%	67.6%
Civil	62.1%	61.8%	61.8%	61.3%	60.6%	60.1%
EE&Comp	79.4%	79.4%	79.3%	79.1%	78.5%	79.1%
Industrial	83.8%	82.4%	81.1%	80.2%	79.4%	79.4%
Mechanical	88.2%	88.2%	88.2%	88.2%	88.4%	89.2%
Other eng	54.5%	54.7%	54.6%	55.1%	55.5%	55.9%

Published every 5 years – most current available as of 6/2005

updated 6/13/05 kt

DoD Civilian S&E's in 1985 & 2005

All DoD Civilians in S&E Occupational Series

	S&E Employees		50+		% ≥ 50	
	1985	2005	1985	2005	1985	2005
< BS	11276	7586	3593	2449	**31.9%**	**32.3%**
BS	67449	54673	15232	15390	**22.6%**	**28.1%**
MS	21973	22515	5955	9701	**27.1%**	**43.1%**
Ph.D.	5594	5777	1864	3262	**33.3%**	**56.5%**
Total	106292	90551	26644	30802	**25.1%**	**34.0%**

Source: DMDC Data for Sept, 1985 & April 2005

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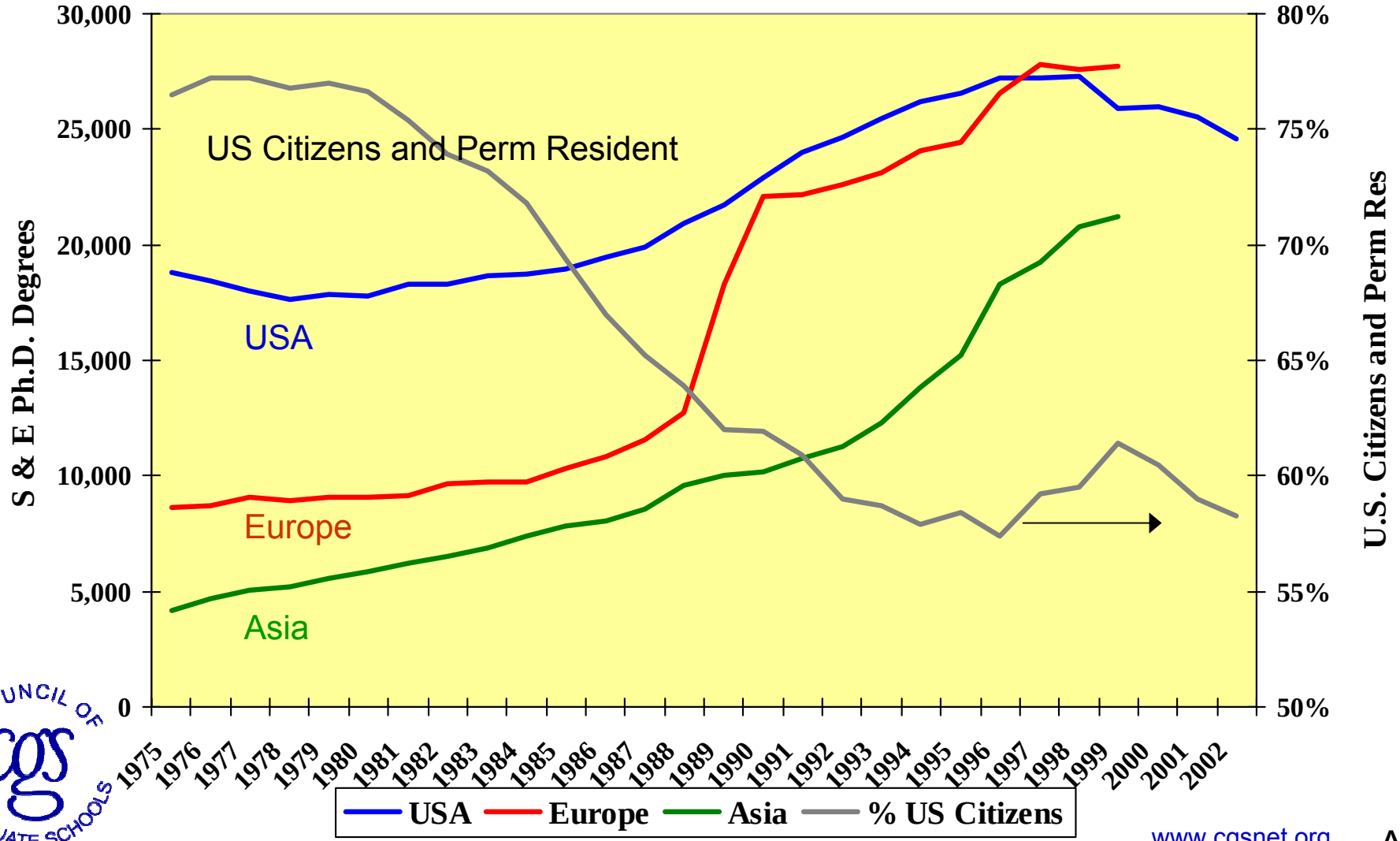
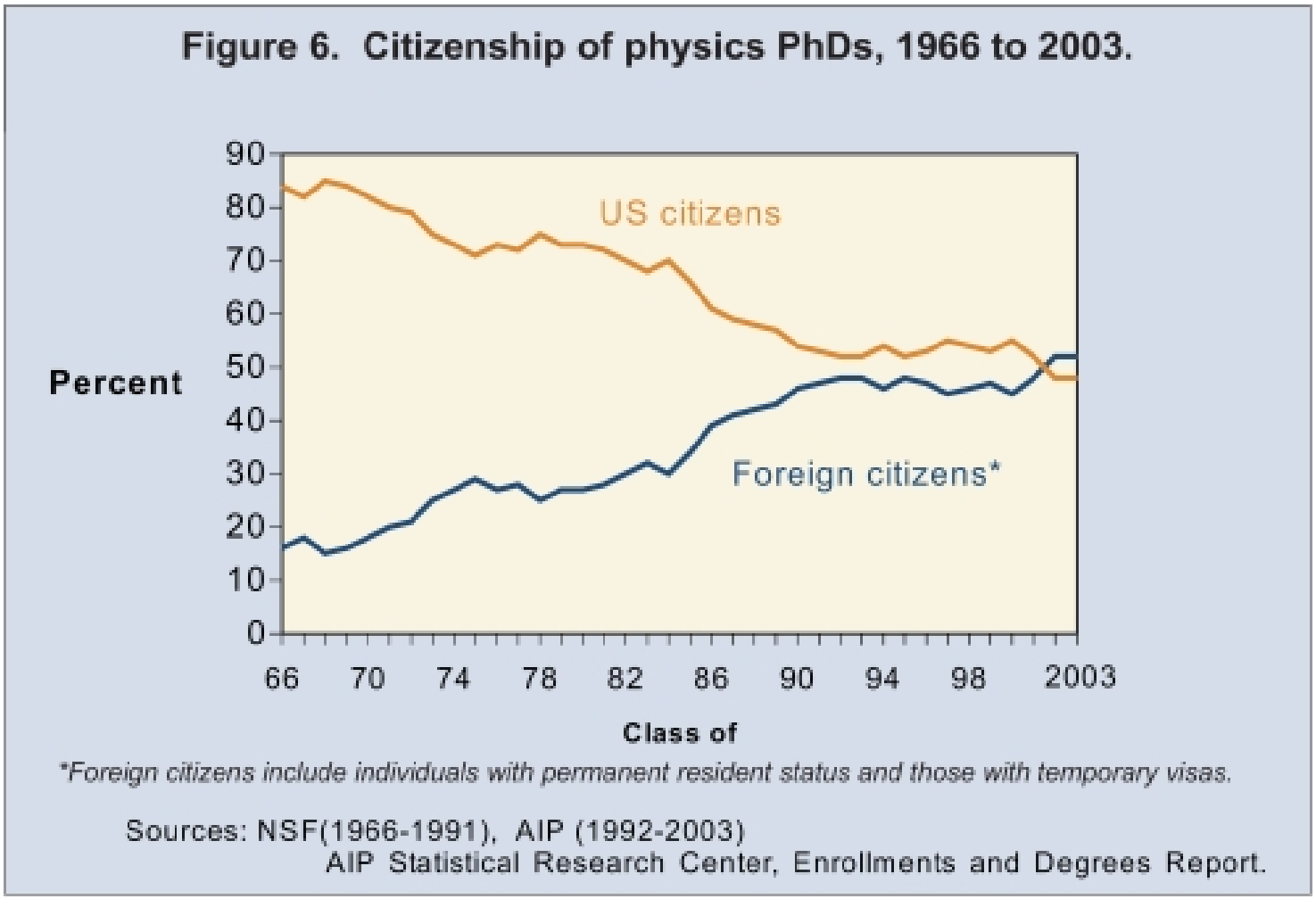
updated 6/13/05 kt

Doctoral S&E Degrees by World Region



Source: NSF Science and Engineering Indicators

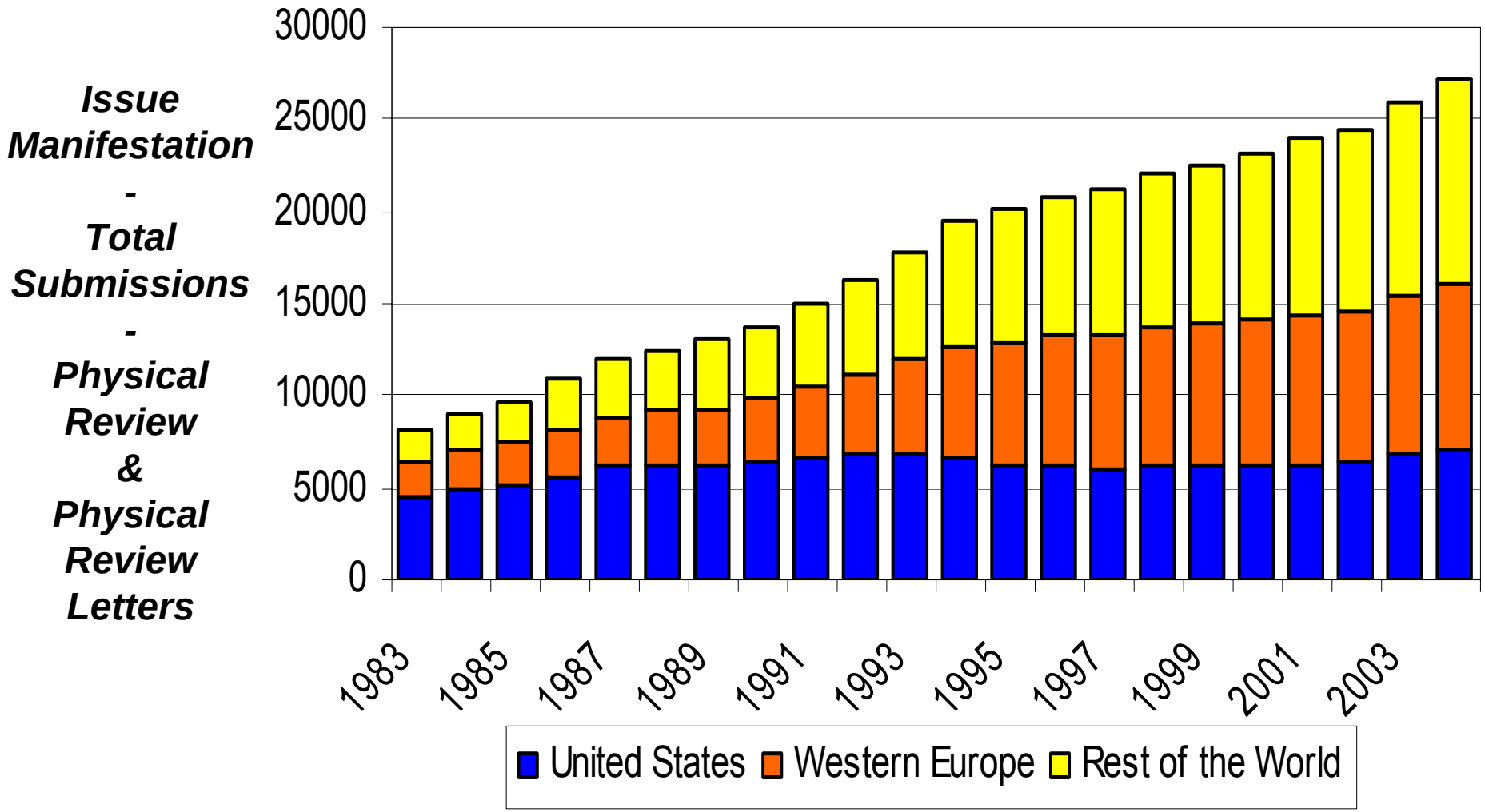
Physics PhD Degrees



Source: AMERICAN INSTITUTE OF PHYSICS http://www.aip.org/statistics/trends/highlite/ed/figure6.htm
http://www.aip.org/statistics/

Physical Review Submissions

Submissions to the Physical Review and Physical Review Letters 1983 - 2004



Source: American Physical Society – *Data from Editor in Chief, August 2005*

Most recent data available at: http://forms.aps.org/general.html

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Kt mod-8/17/2005

Defense Industry Perspective

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Quick-Look Presentation
August 31, 2004

- Industry Demand Data
  - Survey responses highly indicative of a high demand/low supply market place with future negative trends for US Citizens
- Workforce Demand Thematic
  - **Perfect Storm Analogy is real – not just anecdotal**
  - Focused on cleared and clearable engineers
- Employment Considerations
  - Priming the pump is only first step – effective utilization and retention are critical!

AIA

AEROSPACE INDUSTRIES ASSOCIATION

Report on
Aerospace Workforce
March 26, 2004

- Immediately reverse the decline in scientifically and technologically trained US workforce…
- **America's breakdown of intellectual and industrial capacity threatens national security and our capability to continue as a world leader**
- Substantive, long-term US Gov. investment in SME education and training at the undergraduate and graduate levels

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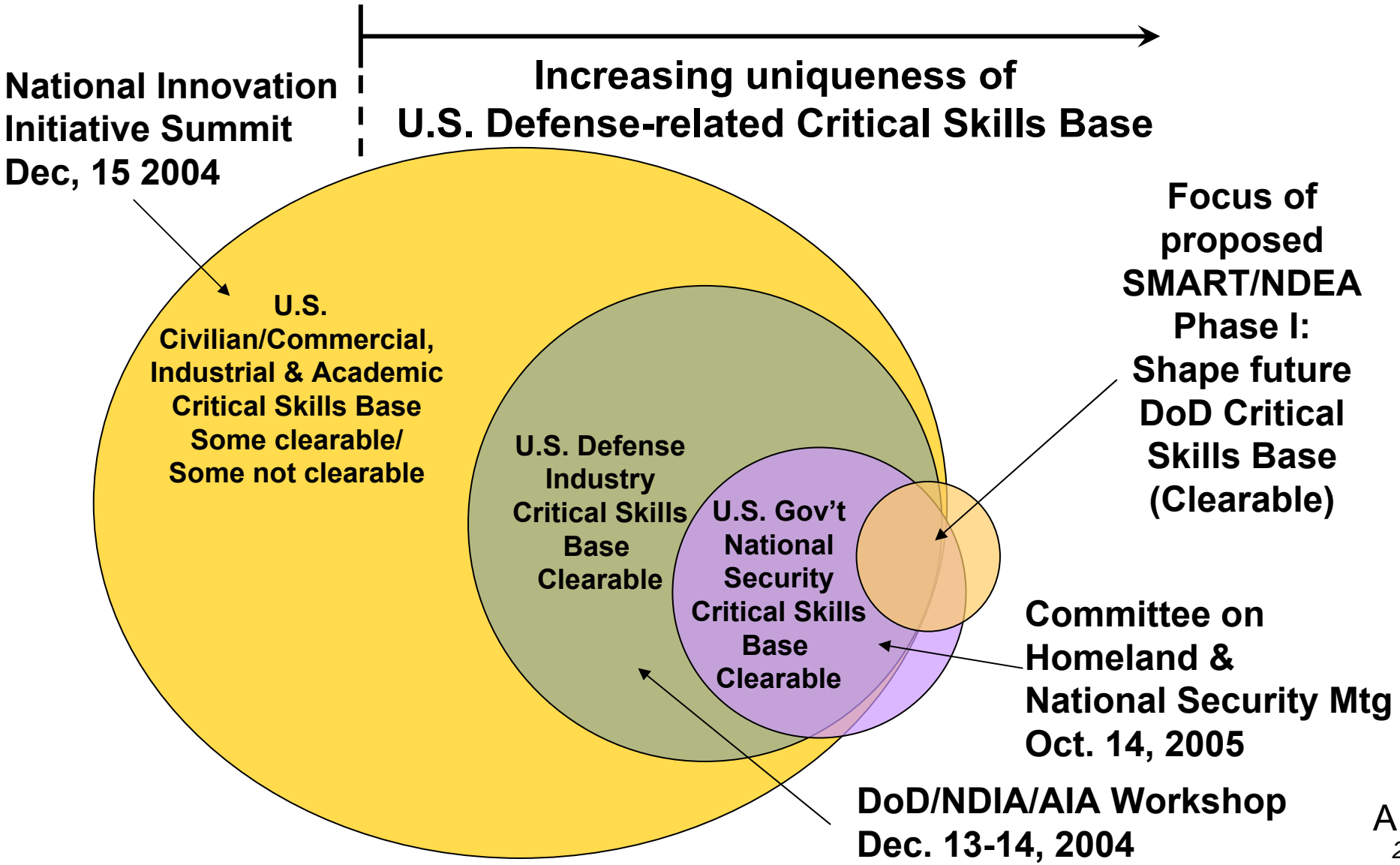
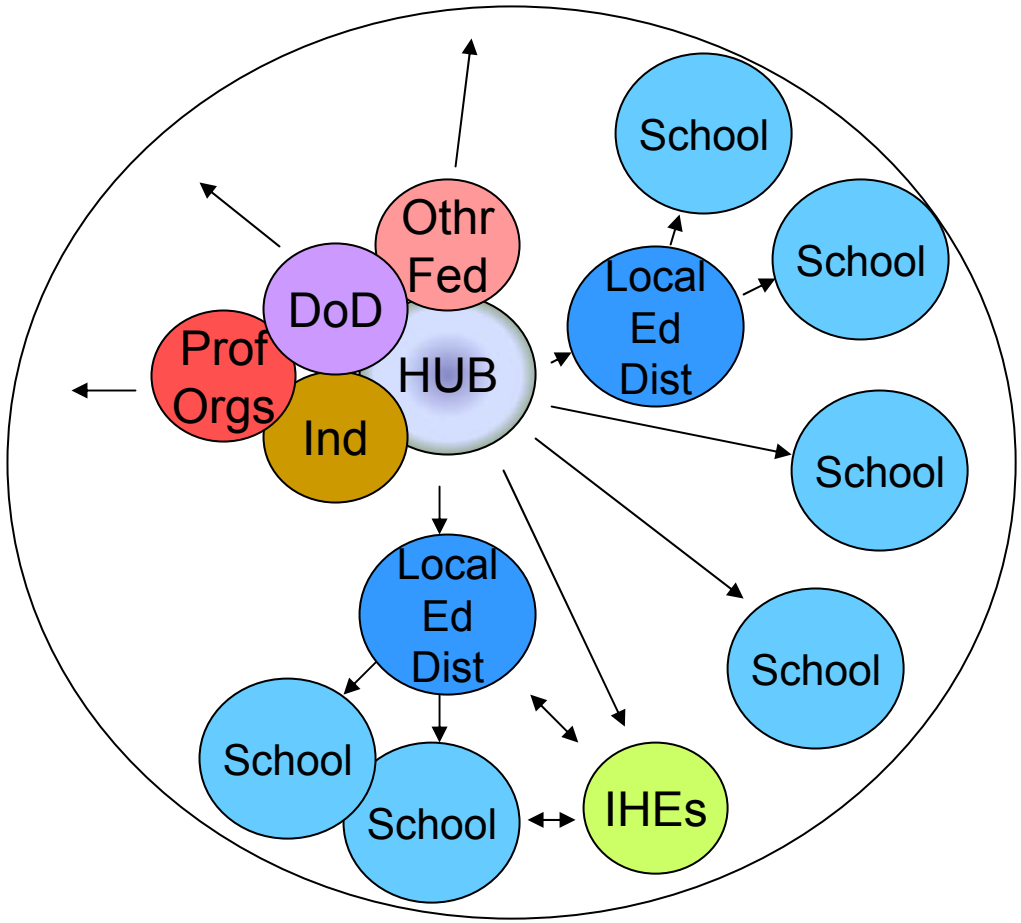
Initial DoD Critical Skills Focus

Proposed SMART/NDEA Phase 1 Relative to Other U.S. Sectors



A Model for Outreach/Integration

- HUB & Spoke Interface
  - HUB should be Strongest Presence
  - Easier Coordination
  - Local Meetings
- Comprehensive Delivery
- Critical Mass
- Greater Impact Training Teachers
- Improved ROI <u>For Everybody</u>

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